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COMPUTER INTEGRATION BY VOCATIONAL TEACHER EDUCATORS

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Abstract

Vocational educators today face the challenge of utilizing and integrating computers and related technologies into their instruction in a manner that enhances student learning and achievement. Modeling appropriate uses of these resources by teacher educators in the preservice classroom can help equip future vocational teachers with the necessary knowledge and skills to use these tools effectively in their classrooms. A nationwide survey of vocational teacher educators from all major program areas revealed that the traditional computer tools, especially word processing, are receiving regular use in the preservice classroom. On the other hand, newer technologies such as authoring software and multimedia applications, are not yet integrated into the preservice curriculum on a regular basis. Vocational teacher educators are challenged to explore these new technologies, develop appropriate uses within their specific discipline, and share these new tools with the tomorrow's vocational educators.

In the 1980s, no single instruction-related innovation caused as much excitement as the computer. Bork (1985) declared that computer use in education was a highly dynamic technology and would become the dominant delivery system in the following 25 years. School personnel began to acquire computers, and results of a recent study conducted by the Office of Technology Assessment (OTA) (1995) estimated that U.S. schools had one computer for every nine students, for a total of 5.8 million computers. The computer appeared to have potential for teaching and learning; two meta-analysis studies of early research efforts investigating computer-based instruction reported increased achievement scores, reductions in necessary

learning times, and improved attitudes toward instruction (Kulik & Kulik, 1987) and statistically positive effects on a majority of the areas examined (Roblyer, 1988).

Despite the enthusiasm toward this new tool, the potential of increased instructional effectiveness, and an enormous financial investment, computers appear to have made little impact on today's schools (Becker, 1991; Bosch, 1993). Reported classroom computer use is minimal (two hours a week or less for the average student), and the most common uses are routine: basic skill practice at the elementary level and word processing and other computer-specific skills in the middle and high schools (OTA, 1995). Other advanced tools appear to be used much less frequently. Dyrli and Kinnaman (1994) stated, "Technology has transformed every segment of American society--except education . . . schooling today remains much the same as it was before the advent of the personal computer" (p. 92).

Barriers to using technology in education include lack of teacher time, limited access and high costs, lack or vision or rationale for technology use, lack of training and support, and current assessment practices that may not reflect what has been learned with technology (OTA, 1995). The need for teacher training is echoed throughout the literature, addressing computer use in vocational education. According to a series of studies, lack of expertise in using the computer was a major barrier to using the microcomputer and related equipment (Birkenholz & Stewart, 1991), computer anxiety decreased with an increase in computer competence (Fletcher & Deeds, 1991), and attitudes toward computers improved with the completion of a hands-on computer literacy course (Martin & Lundstrom, 1988). Fletcher and Deeds (1991) recommended incorporation of additional computer courses in vocational teacher education programs, as well as inservice training for secondary vocational teachers to decrease anxiety and increase computer confidence and knowledge.

Within preservice teacher preparation, OTA (1995) researchers found that while there is increased attention to the need to prepare new teachers to use technology effectively, most new education graduates still have limited knowledge of how technology can be used in their professional activities. Based on the report findings, the authors concluded that "Overall, teacher education programs in the United States do not prepare graduates to use technology as a teaching tool" (p.184). To ensure that future teachers can effectively integrate computers into instruction, a comprehensive set of guidelines for general technology training for all teacher preparation programs was developed by the International Society for Technology in Education (ISTE) (1993) and adopted by the National Council for Accreditation of Teacher Education (NCATE) effective September, 1994. These standards established necessary computer-related skills for individuals seeking initial certification or endorsements from teacher preparation programs. Competencies focus on the ability of teacher candidates to utilize and integrate a wide variety of educational computing and technology applications to enhance student learning and to increase teacher productivity.

Wetzel (1993) proposed that because of the breadth and depth of these requirements, many of these competencies can be achieved by teacher candidates only by effective integration into the entire preservice curriculum. Wetzel's model for preservice preparation includes three components:

1. A core computer literacy course. The subject matter of this course would be applicable to preservice teachers in all subject areas and would provide basic computer skills required by the ISTE/NCATE standards.
1. Methods courses in which instructors model computer integration. Wetzel (1993) emphasized that education professors are required to use computer technology to facilitate instruction in all curricular areas so that students will observe the use of technology within their discipline. In addition, students can practice teaching with these tools. From these experiences, students learn to utilize tools used within their specific discipline and how to integrate them into their instruction.
1. Technology-rich field experiences. Preservice teachers need opportunities to observe students and teachers effectively using technology in K-12 settings. These experiences reinforce the learning occurring within the core course and activities within methods courses.

Purpose and Research Objectives

Based on Wetzel's (1993) model of training for effective technology use for preservice teachers, the purpose of this study was to determine the level of computer integration by vocational teacher educators within undergraduate vocational teacher preparation courses. The study further sought to determine significant differences in computer resource usages within vocational program areas. Specifically, objectives of the study were to:

1. Determine the level of usage for 18 selected computer resources by vocational teacher educators in undergraduate teacher preparation courses.
1. Identify significant differences in total resource usages among the major vocational program areas.
1. Identify significant differences in the categorical resource usages among the major vocational program areas.

Importance of the Problem

The results of this study provide a baseline measurement of the level of computer integration within the overall vocational teacher preparation curriculum as well as each vocational program area. This measurement provides useful information for vocational teacher preparation programs and faculty members examining their own computer integration efforts, as well as establishing a focus for future curriculum development endeavors. In addition, vocational program areas that are identified as significantly higher users in various computer resources could serve as leaders and provide other vocational teacher educators with strategies and techniques for integrating these resources into instruction within their own disciplines.

Methods

Subjects

The population for this nationwide study was vocational teacher educators employed at institutions with undergraduate vocational teacher education programs. Fifty vocational teacher educators were selected from each of the following major vocational program areas: agricultural education, business education, home economics education, and industrial technology/trade and industrial education. For the purpose of this study, the vocational program areas of trade and industrial education and industrial technology education were combined into one group designated "industrial education." Because of the small population totals, all identified teacher educators within the program areas of health occupations (26) and marketing education (56) were included in the sample. In total, 282 teacher educators were selected through the sampling procedures described below.

Sampling procedures began with the identification of those institutions offering undergraduate vocational teacher programs through professional association directories of the vocational program areas. Based on the roll of a die, every fourth institution was selected. Within each designated institution, one teacher educator was selected to receive the survey instrument, based on an additional roll of a die. Because this study focused on the use of computers in the classroom, department chairpersons and other administrators with possible high percentages of non-teaching duties were not included in the sampling process.

Instrumentation

The data were collected through a mailed questionnaire. The instrument included a Resource Usage Scale, which contained a list of computer-related resources commonly used in educational settings. This list was compiled utilizing current literature and personal observations and reviewed by a panel of teacher educators. Participants were asked to indicate how often they and/or their undergraduate students used each computer-related resource as a tool in the courses that they teach during an academic year. Specific instructions were provided that directed respondents **not** to include uses designed for skill acquisition, e.g., a word processing course, or personal uses for non-instructional activities. A 4-point Likert-type scale was utilized to assess the level of usage for each resource with the following scale: 1=Never, 2=Sometimes, 3=Often, and 4=Quite Often. A Total Usage score was calculated by summing the responses to each of the provided items. Categorical Usage scores were determined by summing the appropriate responses to the resources listed in

the following categories:

1. Productivity software. Word processing, spreadsheet, database management, and integrated software.
1. Graphic applications. Graphics, presentation, and desktop publishing software.
1. Interactive technologies. Authoring software, multimedia, and CD-ROM.
1. Telecommunications resources. The Internet, electronic mail, commercial on-line services, and electronic bulletin boards.
1. Computer-assisted instruction. Simulations and games, drill and practice, tutorials, and discipline-specific programs.

Reliability tests utilizing the SPSS Version 4.1 program were conducted on the Total Usage scale using data from the actual study. An overall reliability alpha coefficient of .82 was calculated. Reliability alpha coefficients on the resource categories were: productivity software, .81; graphics applications, .83; interactive technologies, .70; telecommunications activities, .83; and instructional aids, .83.

Demographic information was also collected in the areas of general, institutional, and computer-related information. A pilot questionnaire was distributed to teacher educators at the University of Idaho and Washington State University. The format of the questionnaire was revised to improve the document's appearance and ease the task of completion.

Data Collection

The data collection packages, each consisting of an instrument, a personalized cover letter, and a self-addressed, stamped return envelope, were mailed in February, 1994, to the 282 selected vocational teacher educators. The questionnaires were numbered to identify non-respondents. A follow-up package was sent approximately 4 weeks after the initial mailing. The total return rate was calculated at 72% (219 questionnaires). Response rates among vocational program areas were: agricultural education, 73%; business education, 70%; health occupations education, 73%; home economics education, 65%; industrial education, 72%; and marketing education, 81%. Of the total responses, 183 (65%) were considered complete and used for data analysis.

Data Analysis

The t-test was utilized to compare early respondents and late respondents on the Total Usage scores of the Computer Resource Scale. Results of the t-test indicated no significant difference at the .05 level between the two groups. Therefore, it is assumed that no significant differences existed between early and late respondents. Furthermore, it is assumed that these respondents are representative of the population (Miller & Smith, 1983).

Summations of frequencies and measures of central tendencies were used to rank computer resources in frequency of use. A multivariate analysis of variance (MANOVA) was utilized to determine if there was a significant difference on Total and Categorical Usage scores among program areas. Univariate analysis was then employed to determine if a significant difference existed within each Usage score among program areas. The Newman-Keuls multiple comparison procedure was used for follow-up analyses to determine which vocational program areas significantly differed in computer uses.

Results

Demographic Information

The overall average age of the respondents was 49 years, and approximately 70% of the respondents were between the ages of 40 and 59. The overall average experience in college teaching was 17 years. Agricultural education and industrial education participants were predominantly male (91% and 95%), while all home economics education respondents were female. A high percentage (93%) of the respondents reported using a computer for personal or administrative use, while 97% indicated that they and/or their students utilize

computers for some aspect of instruction. A computer located in their faculty office was reported by 95% of the respondents, while a majority (82%) also owned a home computer.

The overall mean for computer experience was 8.7 years, ranging from 10.2 years for business educators to 6.0 years for home economics respondents. Within each of the program areas, more than half of the respondents stated that a computer course was required for students enrolled in their major. The number reporting a computer course requirement by the state certification agency was significantly lower, ranging from health occupations education (25.8%) to business education (56.1%).

Individual Resource Usage

Table 1 indicates that word processing appears to be the computer resource most widely used in the classroom by vocational teacher educators and their undergraduate students, with 50.8% reporting classroom usage of this resource as "Quite Often," and only 8.3% indicating no use of this resource. Word processing was the single listed computer resource to receive a mean usage score ($\underline{M}$=3.2) higher than "Often" (3.0). The following resources received a mean usage score between 2.0 (Sometimes) and 3.0 (Often) on the Individual Usage scale: graphics software, integrated software, and spreadsheet applications, electronic mail, discipline-specific software, database applications, presentation software, and desktop publishing.

Insert Table 1 about here

The lesser-used computer resources listed in order of usage means were the Internet, computer simulations, tutorials, drill and practice programs, CD-ROM, multimedia, and electronic bulletin boards. These resources received a mean usage score of between 1.5 and 2.0, with 1=Never and 2=Sometimes. The remaining computer resources were commercial on-line services and authoring software, both of which received a mean usage score of 1.4.

Resource Usage by Program Area

The health occupations education program area was excluded from these comparisons because of the small population total and limited number of usable responses ($\underline{n}$=9). A multivariate analysis (MANOVA) was conducted on the Total and Categorical Usage scores. The results of the MANOVA indicated a significant effect for program areas, $F(5,172)=2.5$, $p<.001$. Univariate F-tests revealed significant differences among the program areas for each of the Usage scores (See Table 2).

Insert Table 2 about here

Table 3 displays the results of the Newman-Keuls multiple comparison tests that were used to determine which vocational program areas differed significantly on various types of computer resource usage. In Total Usage scores, industrial education respondents reported significantly higher use than teacher educators in the vocational program areas of agricultural education, marketing education, and home economics education did. Business teacher educators reported significantly greater total computer usage than marketing education and home economics education respondents.

Insert Table 3 about here

In Categorical Usage scores, business education teacher educators reported significantly higher usage in the productivity software resource category than participants in the remaining program areas did. Within the graphics applications category, reported uses by industrial education respondents were significantly higher than those reported by agricultural education, marketing education, and home economics teacher educators. In addition, use by teacher educators in business education was significantly higher than for teacher educators in agricultural education and home economics education. Industrial education respondents reported significantly higher usage within the categories of telecommunications activities and interactive technologies than participants in the remaining program areas of agricultural education, business education, marketing education, and home economics education. Within the computer-assisted instruction category, use by

industrial education personnel was significantly higher than uses by agricultural education teacher educators.

Discussion

Demographic Information

Respondents aged 40 and older accounted for 83% of the total responses, and it is likely that these individuals did not receive instruction in how to use the personal computer as part of their formal education. However, it appears that most vocational teacher educators have utilized computers for a significant period of time (M=8.7 years). This suggests that these individuals realized the potential usefulness of computer applications and acquired skills through various methods.

The establishment of a computer course requirement for students within the major was reported by at least 50% of the respondents in each vocational program area, despite less rigorous standards set by certification agencies. This finding illustrates vocational teacher educators' understanding of the importance of computers in education.

Resource Usage

Further examination of these results indicates that word processing clearly emerged as the computer resource most frequently used in vocational teacher education. This result is consistent with other research findings in various educational settings that established word processing as the major focus of computer-based learning (Becker, 1991; OTA, 1995). However, 8.3% of the participants indicated that they and/or their students never use word processing in their courses.

Discipline-specific software ranked sixth in mean usage, although in an early study, Kansas secondary agricultural teachers had listed this resource as their most commonly used computer tool (Raven & Welton, 1989). In addition, computer simulations, tutorials, and drill and practice were ranked relatively low on the Usage scale. These resources appear to be receiving average to minimal use in vocational teacher education programs, while other research findings indicate these types of programs are used frequently in the public schools. The usage scores on this study may indicate that vocational teacher educators may not be providing adequate exposure for their preservice teachers for these types of computer resources. Another contributing factor to this lower usage of computer-assisted instruction may be the lack of high quality software specific to various vocational program topics. Within home economics, a recent study indicated that the greatest need for implementing computer aided instruction in clothing and textiles courses was the development of software appropriate to these areas (Rogers, Thompson, Cotton, & Thompson, 1993).

The categories of telecommunications and interactive technologies both received mean usage scores of between 1.5 and 2.0 (1=Never and 2=Sometimes). At least one-third of the respondents had never utilized electronic mail or the Internet as an instructional tool. Approximately 50% of the respondents reported never using CD-ROM and multimedia resources, while 71% reported no usage of authoring software. Because these resources are fairly new in development, and may require special hardware and more technical expertise, these results were not unexpected. However, a recent nationwide study of public school districts (Bruder, 1993) showed that 74% owned modems and 73% had CD-ROM drives. Clearly, these resources are available in public schools.

Usage Among Program Areas

The findings of this research indicate that industrial education teacher educators consistently placed in the group of highest users in total and categorical computer usage scores, with the exception of the productivity software category. In addition, they report significantly higher usage than all remaining program areas in the categories of telecommunications activities and interactive technologies. These two categories were found earlier in this study to receive less frequent usage by the entire sample than the categories of productivity software and graphics applications. These findings suggest that the industrial education area has become the leader within vocational teacher education in utilizing new technologies and incorporating them in classroom

activities.

In addition, the research findings indicate that total computer usage by business teacher educators was determined not to be significantly different from agricultural education respondents' total usage. This result may be surprising for individuals who perceive business educators to be consistently high users in all types of computer utilization. Furthermore, this finding may create a new awareness of the level of computer usage in agricultural teacher education.

Further investigation reveals that business education teacher educators reported the highest usage in productivity software. Because skill acquisition in this resource category is an integral part of the business education curriculum, it is reasonable to assume higher usage would be reported. However, the findings indicated that respondents in business education and marketing education had similar usage levels of graphics applications resources. In the categories of telecommunications activities, interactive technologies, and computer-assisted instruction, uses by business teacher educators were comparable to most of the other vocational program areas. These results may suggest that business teacher educators, while utilizing traditional, familiar types of computer resources at high levels, are not incorporating these newer technologies into their instruction at a more rapid pace than other vocational program areas.

Teacher educators in the vocational program areas of agricultural education, home economics education, and marketing education appeared to have comparable uses of computer resources. No significant differences were found between these groups on total and categorical uses of computers.

Future Research Opportunities

Traditional tools of the computer, specifically productivity software and graphics applications, are receiving regular use for instructional purposes by many vocational teacher educators. It is possible that these usages will serve as a foundation as individuals begin to explore the newer technologies of telecommunications and interactive technologies. This investigation of these new tools has already begun, as illustrated by the finding that over half of the respondents indicate some usage of electronic mail and the Internet.

Since the results of this study primarily focused on the use of traditional, commonly used computer-related resources, many new technologies were intentionally omitted from the resource list. Usage of these newer technologies not included in this study, such as interactive videodisks, scanners, digitized cameras, etc., should also be investigated to determine levels of usage for these resources. In addition, further investigation into individual program areas should focus also on how these resources are utilized in the preservice classroom. Information in this area would provide valuable information about how teacher educators have chosen to utilize these resources in their classrooms, initiating an exchange of ideas among computer-using teacher educators. These efforts would build an updated, more comprehensive knowledge base of computer usage practices in the preservice vocational teacher preparation curriculum.

This study also has widespread implications for curriculum development. Curriculum guides and other materials that effectively utilize a wide variety of computer-related resources in the vocational education curriculum are vitally needed to provide guidance in using these tools. Camp and Sutphin (1991) advocate more timely curriculum guides to address educational computing in agricultural education; the results of this study extend that recommendation to all vocational program areas. These curriculum guides would be valuable for the preservice program, allowing future teachers to practice teaching with these technologies before beginning their teaching careers. In addition, inservice teachers would benefit from these instructional resources.

Model programs that investigate and develop uses of traditional and newly emerging technologies to significantly enhance the instructional process should also be established. These exemplary programs could provide innovative applications of technology that could be shared with the vocational education community. Because industrial education respondents emerged as leaders in these newer technologies, it is reasonable that individuals in this program area should be among those who take the lead in developing effective educational applications of these technologies. Their findings could then be shared with teacher educators,

teachers, and other individuals within industrial education, as well as other program areas, to improve their usage of computers and related resources in the classroom.

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Table 1
Individual Resource Usage by Vocational Teacher Educators in Preservice Instruction

Resource	Mean	SD
Productivity software	2.5[a]	
Word processing	3.3	1.0
Integrated software	2.2	1.0
Spreadsheet	2.2	1.0
Database	2.2	1.0
Graphics applications	2.2[a]	
Graphics software	2.4	1.0
Presentation software	2.1	1.0
Desktop publishing	2.0	1.0
Computer-assisted instruction	1.9[a]	
Discipline-specific programs	2.2	1.1
Simulations	1.9	.9
Tutorials	1.9	.8
Drill and practice	1.9	.8
Telecommunications activities	1.8[a]	
Electronic mail	2.2	1.1
Internet	1.9	1.0
Electronic bulletin boards	1.6	.8
On-line commercial services	1.4	.7
Interactive technologies	1.6[a]	
CD-ROM	1.7	.8
Multimedia	1.7	.7
Authoring software	1.4	.7

[a] categorical mean

Scale: 1=Never, 2=Sometimes, 3=Often, 4=Quite Often

Table 2
Univariate Analysis of Variance for Computer Integration by Vocational Program Areas

Source of Variation	Variable	Univariate F	p£
Vocational program area	Productivity software	5.5	.001
	Graphics applications	5.7	.001
	Computer-assisted instruction	3.1	.01
	Telecommunications activities	3.5	.01
	Interactive technologies	4.1	.001
	Total use	5.5	.001

Table 3
Results of the Multiple Range for Usage Scores on Computer Resource Scale by Vocational Program Areas

Usage Scale	Vocational Program Areas				
Total Usage	HE n=31	ME n=33	AE n=32	BE n=41	IE n=37
Means	35.4	36.4	38.1	46.1	46.2

Productivity Software	HE	ME	AE	IE	BE
Means	8.6	8.8	9.4	10.2	11.6

Graphics Applications	HE	AE	ME	BE	IE
Means	5.3	6.0	5.8	7.1	8.0

Telecommunication Activities	ME	HE	BE	AE	IE
Means	6.0	6.3	7.0	7.4	8.6

Interactive Technologies	HE	ME	BE	AE	IE
Means	4.0	4.5	4.7	4.8	5.8

Computer-Assisted Instruction	AE	HE	ME	BE	IE
Means	6.7	7.2	7.4	8.4	8.9

AE=Agriculture; BE=Business; HE=Home Economics; IE=Industrial; ME=Marketing

Note: A single line under two or more vocational program areas for a given Usage score indicates that the program areas do not differ at the .05 level with respect to that variable.

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